

Cassini's Millennium Flyby

On 30 December 2000 at 10:03 UTC, the Cassini spacecraft will make its closest approach to Jupiter. This flyby is necessary in order to give Cassini the final increment of energy to reach its ultimate destination: Saturn.

Jupiter Flyby Facts

Date: 30 December 2000

Closest Approach Time: 10:03 UTC
02:03 a.m. Pacific Standard Time

Altitude above cloud tops at closest approach: 9,721,846 kilometers
(6,042,167 miles)

Jupiter Trivia

Jupiter is the largest planet in our Solar System. At the equator, Jupiter's diameter measures 141,592 kilometers (88,000 miles). 11 Earths would fit along Jupiter's diameter! Jupiter's polar diameter is smaller. Centrifugal force due to Jupiter rapid rotation (1 day = 9 hours 50 minutes) "squashes" the planet.



Millennium Flyby Science

While Cassini's actual flyby of Jupiter doesn't occur until 30 December 2000, the instruments will begin collecting data in early October. Data will be collected until late March 2001. Some of the highlights of Cassini's scientific plans for Jupiter include:

- * Studying Jupiter's atmospheric composition and dynamics, the aurora, lightning, and heat flow.
- * Studying Jupiter's rings.
- * Observing Jupiter's moons Europa and Callisto at opposition (the position where they are exactly on the Sun-Cassini-moon line).
- * Studying Jupiter's moon Himalia and determining the satellite's rotation period.
- * Observing Jupiter's moon Io in eclipse.
- * Studying Jupiter's magnetosphere and its interaction with the solar wind.
- * Observing Io's dust stream.
- * Observing Jupiter's synchrotron radiation (natural radio emission caused by spiraling electrons).
- * Joint studies with the Galileo spacecraft, which is currently orbiting Jupiter.



Check It Out

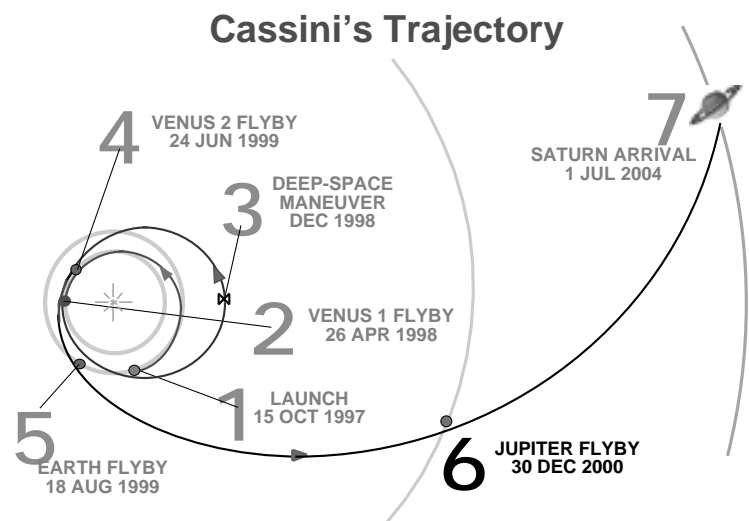
See Jupiter data from Cassini and learn about the flyby and the mission at the Cassini web site: <http://www.jpl.nasa.gov/cassini>

It's All in the Name

Jupiter is the supreme god in Roman mythology. The name changed to "Jove" in Middle English and is the basis for the term "jovial." During the middle ages, Jupiter's influence was believed to be one of merriment.

What is a gravity assist?

No launch vehicle exists that is capable of sending a spacecraft as large as Cassini directly from Earth to Saturn. Therefore, mission engineers make use of the gravity of other planets in the Solar System to change Cassini's direction and speed relative to the Sun. When Cassini flies by Jupiter, its speed changes relative to the Sun. By combining flybys of several planets, Cassini can gain enough speed to reach Saturn. The image to the right shows Cassini's entire trajectory (or travel path) to Saturn.



Observing Jupiter in the Night Sky

During Cassini's science flyby of Jupiter over the period autumn 2000 through winter 2001, observers on Earth can see Jupiter in the sky following the Seven Sisters (Pleiades) and leading Orion, the large, familiar winter constellation with three bright stars marking his belt. Jupiter will be the brightest object in that area of the sky, looking like a brilliant white star to the unaided eye. To Jupiter's right, slightly fainter, gold-colored Saturn will be leading it during their nightly swing across the sky from east to west.

Dates when the Moon will be close to Jupiter & Saturn:

16 October 2000
12 November 2000
9, 10 December 2000
6 January 2001
2, 3 February 2001
2 March 2001
29 March 2001

Over the course of the autumn and winter, Jupiter will rise earlier and earlier due to Earth's orbital motion around the Sun. Early in autumn, Jupiter will just be on the eastern horizon around 9:00 p.m. By late autumn, observers will find it is visible in the east as soon as the sky is dark. In December at 9:00 p.m., Jupiter and Saturn will be very high above the southern horizon, with Orion trailing to their lower left. In late winter, the Earth's changing position places the planets high in the west just after dark.

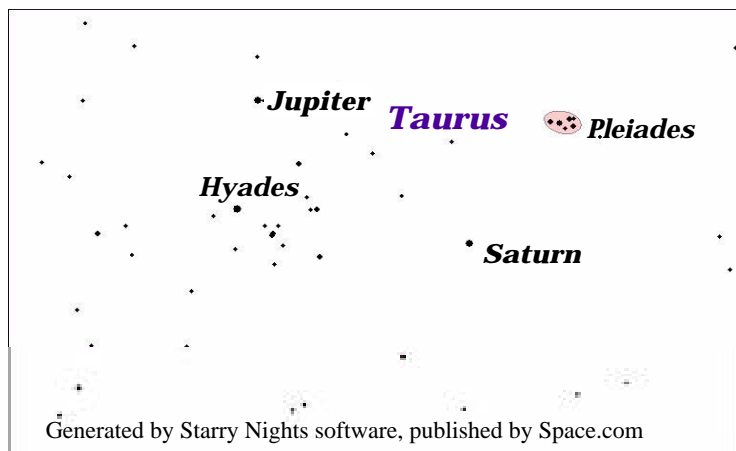
While neither Cassini nor the Galileo spacecraft (in orbit around Jupiter) can be seen with telescopes from Earth (in fact, they can't even see each other), an earthbound observer with binoculars will be able to see Jupiter's four large satellites. In order outward, the moons are Io, Europa, Ganymede, and Callisto. Their orbital periods range from less

than two days to more than 16 days. Over the course of one or more nights, their orbital minuet can be tracked. On some nights, as few as two moons may be visible, either hidden by Jupiter or its shadow or crossing Jupiter's bright face.

Observers with small telescopes can see the movements of Jupiter's moons and will also be able to see some of the dark belts and bright zones marking Jupiter's cloud tops. Small telescopes will also show a dark band across Saturn, Saturn's rings, and its largest moon, Titan. Titan is comparable in size to Jupiter's largest moon, Ganymede, but it is almost twice as far away from Earth and much more mysterious.

Here are some interesting activities for students, stargazers, and families:

1. Chart Earth's orbital motion in October and November. From the same spot in your front or back yard, on a daily basis make note of the time of night that Jupiter first appears on the horizon each evening. Jupiter will appear above the horizon several minutes (how many?) earlier each day. Make a plot of the time of rising versus the date.



2. Chart Earth's orbital motion through autumn and winter. Jupiter and Saturn are both in the constellation Taurus, the Bull, over the full period of visibility. Once each week, carefully sketch the positions of Jupiter and Saturn relative to the background stars. Use stars near them in the sky as reference points. The Seven Sisters (Pleiades) and the Hyades, the V-shaped collection of stars marking the head of Taurus (especially the bright, reddish star Aldebaran, one of Taurus' eyes), are easy to see. Their changing positions reflect their own motion and Earth overtaking them during its annual revolution around the Sun.

3. Using binoculars or a small telescope, sketch the positions of the moons relative to Jupiter. By making nightly drawings over a period of a few weeks it is possible to sort out which moons are which, based on how frequently they circle Jupiter and their maximum apparent separation from the planet. Pretend you are the astronomer Galileo Galilei in 1609 seeing the moons for the first time. How far from the planet does each one get? How long does each take to go from side to side and back? Galileo made similar observations when he discovered the moons of Jupiter. Use a telescope and sketch Titan's motion around Saturn. How long does it take to make a revolution around Saturn?

4. Compare the colors of Jupiter and Saturn to the colors of the brightest stars in Taurus and Orion. Reddish stars (actually salmon-colored) have temperatures of 3,000 to 4,000 degrees Celsius and bluish stars have temperatures exceeding 10,000 degrees Celsius. Jupiter's naked-eye color matches the Sun's. At what temperature would you conclude the Sun is?